the Cliona, Alcyonium, Lobularia, &c. It is interesting to observe, that the earthy matter of the skeleton of these earliest inhabitants of the ocean, is the same with what we know to have paved the bottom of the vast abyss at the remotest periods we can reach of the earth's history, whether we imagine the silica of the primitive rocks formed by the oxidation of the solid surface, or precipitated from the superincumbent fluid. The appearance of many of their crystalline silicious pointed spicula is the same with that of the slender hexaedral acuminated prisms which silica naturally assumes in the crystallized state; and the silicious crystals formed by nature contain cavities and fluids like those formed by organic life. The laws, therefore, which regulate the forms of the simplest silicious spicula composing the skeleton of the marine sponge, do not appear to differ much from those which regulate the forms of brute matter.

Notice of a Voyage of Research. In a Letter from Captain Basil Hall, R. N., to Professor Jameson.

In answer to your questions as to what would be the most useful objects of inquiry, were a voyage undertaken for the express purpose of research, I beg leave to offer you the following remarks,—the result of a good deal of reflection on the subject, and of some personal experience of those points in the investigation most important in practice.

Voyages of discovery, as they were formerly called, seem now at an end; since all, or very nearly all, the navigable parts of the earth have been pretty well explored. Much, however, remains to be done, in order to complete the work commenced by former voyagers, in a manner suitable to the greatly improved means, and the still more enlightened ideas, of the day.

It may assist your apprehension of the subject, to class the different objects of inquiry under distinct heads, that their importance may be examined separately.

First, To make observations having direct and immediate

utility in the practice of Navigation, and the advancement of Geographical Science.

Secondly, To institute experiments, and series of observations, calculated to improve the Theory of Navigation, by furnishing mathematicians with data for the correction of Nautical and Astronomical Tables.

Thirdly, To ascertain the resources, Nautical and Commercial, of remote countries.

Fourthly, To make observations of a scientific nature, in places distant from England, and under circumstances of situation and climate which are not to be obtained at home; and which, independently of their own local value, would in many cases enhance the importance and utility of observations already made; while, at the same time, the field of new knowledge would be extended and enclosed, if I may use such an expression, and that of prejudice and error contracted.

Fifthly, To attend to that class of topics called Popular, having less in view any precise object of utility, than the rational amusement and information of persons who have no means of investigating such subjects for themselves.

The desideratum which is unquestionably of most importance in practical navigation, is the exact measurement of the Difference of longitude between place and place, especially between those headlands and harbours generally used as points of departure by ships starting, or which are looked out for as land-marks on their return voyage. It is not necessary this should be done with that rigorous precision used in trigonometrical surveys. The well-being of navigation, however, certainly requires that this element should be determined within much smaller limits than those which at present bound our information. Without such knowledge, indeed, much of the utility of improving nautical instruments and tables is essentially lost. It may assist your imagination to consider, that the evil of loosely settled longitudes, is quite as great in practice, as if the geographical positions of the places on the earth's surface were supposed to be actually shifted about from time to time. No skill, it must

be obvious to the least informed person, can obviate the perplexing dilemma into which sailors are thrown by tables of longitude, which vary amongst themselves. All the requisite accuracy, it is satisfactory to know, might be attained, and some day will be attained, by the judicious employment of chronometers, and other instruments now in the hands of every seaman.

The absolute longitude of those places, that is to say, their difference measured from the meridian of Greenwich, though not so material for the immediate or daily purposes of the navigator, is not without its share of importance in a geographical, as well as a nautical, point of view, and is one branch of the inquiry which would employ much of the attention of an officer sent upon this service. Collaterally it would become an object of peculiar interest to ascertain which one, of all the numerous methods for solving this problem, is the most applicable to practice, in a given time; and to determine with what degree of precision it can be obtained by the means at present in use. These points are far from being settled in the way they ought to be, either in the purely nautical case, where a ship is out of sight of land, or on shore, at stations where the sailor may have it in his power to erect a temporary observatory.

Under this head, therefore, would fall a series of experiments on the respective value of the various instruments in the hands of travellers, as well as of seamen. This is the more necessary, as there is at present a considerable difference of opinion amongst practical men, which leads to inconvenience, and ill-bestowed expence, and after all the object is not attained.

The difficulty of the longitude problem, or, to speak more correctly, the degree of care requisite in its determination, for there is no other difficulty in the matter, have, perhaps, by giving it an undue importance, thrown some other equally essential points too much out of sight, though in every respect of as much consequence in practice. This remark applies more particularly to the latitudes, and to the variation of the compass in different parts of the world. It often happens, absurdly enough, that, while much labour and discussion are bestowed upon a single mile, or half a mile of longitude, the neglected latitude is not determined within twice the amount, merely because it is more easily obtained. With the variation of the

compass it is still worse: Yet it is obviously of the greatest importance, when steering for any port, especially at night, to know what reliance is to be placed on so fickle a guide as the compass—a guide, it may be remarked, whose tendency at every moment is to deceive—who never tells the same story twice—and who is drawn out of his path by a thousand attractions, which, if not duly watched and counteracted, render his services, like those of a drowsy pilot, the very means of our destruction.

This subject has only very recently been attended to in this hemisphere, scarcely at all in the other. It is, however, a question of such vital importance to navigation, that the experiments suggested by Professor Barlow, and since so ably followed up by Captain Parry and Lieutenant Foster during the recent expedition, should be carefully repeated in the south, and the practical efficacy of the correcting plate invented by the eminent philosopher alluded to, practically examined in remote places, and under various circumstances. We shall thus learn the full extent of this beautiful discovery, which removes the most distracting source of erroneous reckoning that has ever annoyed the navigator.

The phenomena of the winds, though less readily made the subject of observation than the points already alluded to, ought to be investigated in a manner they have never yet been. At first sight, the winds appear less under the influence of known laws than any other element with which the navigator has to concern himself. But experience seems to show, that it is otherwise, since a practised sailor, in a dull sailing ship, will generally make a better passage than one who is not experienced, though in a faster sailing vessel. In almost every part of the globe, the prevalent winds are found to be more or less under the influence of laws capable of being distinctly stated, but which have not as yet been recorded in such a manner as to be intelligible, and practically useful to the seaman. On the other hand, it has happened that theoretical men, by not taking into account local causes, of which, from want of actual experience, or any correct accounts, they could have no just knowledge, have rather contributed to embarrass than to relieve the navigator. Even the well-beaten track, where the trade-winds prevail, is imperfectly and often erroneously de-

scribed in most books of navigation; and with respect to the winds in high latitudes, nothing accurate is recorded; or if recorded, is not put into that shape which is best suited to the comprehension of sailors. The whole of this apparently complex subject might perhaps be treated in a manner applicable to practice, thereby rendering almost all extensive voyages more expeditious and certain.

The mysterious subject of currents, though it may not differ essentially in its nature from that of the winds, differs materially from it in practical operation. Not one current in ten marked on our charts has any existence; and the chief office of these investigations would be the negative but useful one of removing such misstatements entirely. There can be no doubt, at all events, that the much-talked of current in the east of the Atlantic is imaginary, and that a belief of its existence arose entirely from the local attraction of the needle: it vanishes entirely the instant Professor Barlow's correcting plate is affixed to the steering-compass, and returns again whenever the plate is removed.

It may not be uninteresting to state how this curious effect is produced. The local attraction, which is the technical name given to the influence which the iron distributed over the hull exerts upon the needle of the compass, has, in most ships, the effect of drawing its north end forward, or towards the head of the vessel. In the southern hemisphere the reverse takes place. To shew how this produces an apparent current, let it be supposed that a ship steers from the British Channel towards Madeira on a SW. course, *by compass*, and that the navigator, guided by the best documents in his possession, allows two points westerly variation, it is clear he will suppose that his course made good is SSW. But, owing to the local attraction, the north end of the needle has been drawn, we shall suppose, half a point more to the westward, so that in strictness the variation allowed ought to have been 2½ points instead of 2. Thus, the course made good has in fact been S. by W. ½ W. instead of SSW.; and the difference of longitude between the dead reckoning and that shewn by chronometers, he naturally ascribes to a current setting to the eastward, towards the Straits of Gibraltar. On the return, that is to say, when he is steering *by compass* NE., and when, by making the *same* al-

lowance of 2 points westerly variation, he conceives his course made good to be NNE. while in fact it is ½ point more to the eastward, in consequence of the north end of the needle being drawn, as formerly, towards the ship's head, the effect of which would of course now be to diminish the westerly variation, just as much as the same cause acting in the opposite direction had augmented the variation, when the vessel's head was directed to the SW. Therefore, in this case, namely, with the vessel's head to the NE., the real course would be ½ point more to the eastward than the navigator would allow for; and he would, as before, naturally ascribe the difference between his position by dead reckoning, and that by his chronometer, to a current setting to the eastward. I have never read or heard of any current setting towards the Straits of Gibraltar from the Atlantic which this theory would not fully explain. Certainly, however, an exact account of such undoubted currents as the Gulf Stream along the coast of North America, and that off the Cape of Good Hope, would be useful and interesting. Captain Sabine's researches in this respect have already given us some valuable information as to currents near the Equator.

A very useful branch of this class of subjects would be the measurement of the perpendicular rise and fall of the tides in harbours much frequented by shipping, and also the direction of the stream; both practical points of considerable moment, but which in most cases are known only to the pilots and fishermen of the spot, although there is no reason why it should not be known to strangers.

These seem the principal points under the first head of inquiry; but there are many others to which an officer having such objects constantly and exclusively in view, would of course direct his attention.

NAUTICAL SCIENCE.

Under this topic might be classed observations, such as those recently made by Lieutenant Foster at Port Bowen, on atmospherical refraction, the dip of the needle, and the diurnal variation of the magnet. Astronomical observations on the oppositions of the planets, occultations of the fixed stars by the moon, under favourable circumstances, and various other celestial phenomena, might be made to good purpose. Correspon-

dent observations of Jupiter's satellites, and particularly correspondent observations of moon culminating stars, as well as of eclipses, would be very serviceable to the cause of nautical astronomy. It is desirable also to ascertain how far the method of occultations can be practised at sea, and to what magnitude of stars it may be useful to carry the computations in the nautical almanack. Men of science who have turned their attention to these pursuits, would probably furnish the commander of such an expedition with many hints for inquiry, which cannot be suggested by a practical man. There have as yet been no regular and systematic trials made at sea of the relative merits of the various instruments contrived for measuring the moon's distance from the sun and stars. Practical men are divided between the sextant, Troughton's circle, and the repeating circle, and much needless expence is often incurred by persons who can ill afford such outlay. The readiest, as well as the most exact methods of making lunar observations and chronometers mutually assist one another, have never yet been properly stated.

NAUTICAL SUPPLIES.

A wide field for the diligence of any officer so employed, is presented under this section, and, if duly explored, could not fail to prove highly beneficial to the country. The peculiar resources of the distant parts of the globe are extremely little known: indeed up to a recent period, it was of no great importance that they should be so. Now, however, that the trade of the eastern seas and of South America is thrown open, and that with China and Japan will soon undoubtedly follow, it becomes of the first consequence that our traders should have some further knowledge of the resources of ports far from home, independently of all objects merely commercial. A ship may be dismasted in the middle of her voyage, or spring a leak, or run short of provisions;—her crew may become sickly;—she may lose her anchors and cables, or split her sails; and it may become essential to the very existence of the whole enterprize, that some re-equipment should take place. But it is quite possible, that, under such circumstances, the master of the ship may be entirely ignorant in what direction he ought to proceed; he may, and in fact very often does, make the most ruinous mistakes. The remedy for this

evil, which is of perpetual recurrence, lies in having distinct accounts properly arranged and methodised of the resources of all the chief ports of the world. It signifies nothing to tell the seaman or shipowner that there have been already hundreds of voyages written, and that the requisite information is somewhere upon record; for, although this may be true, still it is not to be had in a shape which seamen can avail themselves of. Either the circumstances under which those voyages have been written are materially altered, as in the case of all the South Sea Islands, New Holland, and South America, or the information is scattered over long works, written with no such views, and, like the nautical observations which most voyages contain, entangled with narratives, or other extraneous matter, from which it is impossible to free them, or turn them to account at the moment of need.

These remarks apply particularly to the necessities of trading ships; but it would be of use also to ascertain the resources suitable to King's ships in the same places, in the event of war.

Much vexatious delay is often caused abroad by the ignorance of traders as to the local regulations of the different ports; and it has sometimes happened, that unpleasant discussions have arisen even between the government of those places and the captains of his Majesty's ships, on points respecting which no previous diligence on their part could have given them information. Actual inquiries, regularly instituted on the spot, and for this express purpose, are the only means of obtaining the local knowledge which would prevent these embarrassments. Every one at all acquainted with remote foreign stations, knows how continually such difficulties are produced by ignorance of what is customary.

GENERAL SCIENCE.

In considering the scientific observations which might be made on such a voyage, those for determining the length of the seconds pendulum occupy the first place. The figure of the earth is a question which at present occupies much of the attention of the scientific world; and this method of determining the point is one which might be pursued with great advantage during the progress of these inquiries, without essentially interfering with the more practical and useful objects already ad-

verted to. The ingenious contrivances of Captain Kater, have already been shewn to be available in the hands of seamen, and we know also, that the time requisite for the performance of these interesting experiments is not great.

There have already been a considerable number of such observations made by *different* observers, and with *different* instruments. But the nature of the experiment is such, that this circumstance, which in most other similar matters add to the value of the work as a whole, in this case are not quite so satisfactory; for the experiments with the invariable pendulum are so strictly comparative in their nature, that, in order to deduce any valuable conclusions from them, they ought to be used by the same observer under similar circumstances, but in very different situations; so that the object in view, the determination of the unequal figure of the earth, might be the sole cause of difference in the result. It would be highly desirable, therefore, to ascertain the length of the pendulum at stations both near to and remote from the equator, in the southern hemisphere, where the question is fully of as much importance as in this.

To investigate by actual trial the effect of local density, or that which is caused by the nature of the ground at the station, on the vibrations of a pendulum, has been considered a most interesting desideratum. To accomplish this, however, it is essential that the same instruments be used, swung at a series of stations, lying not in different latitudes, as in the first case alluded to, but along the same parallel, where, according to theory, the number of vibrations of the same pendulum, after allowance for temperature has been made, ought to be alike; and consequently the amount by which they should be ascertained to differ, would express the effect of this disturbing cause. Once ascertained, this would become a valuable element in the reductions, and would be applicable generally to every previous or subsequent experiment on the length of the pendulum.

The measurement of the height of mountains, by means of the barometer, in conjunction with levelling and trigonometrical operations, and in different climates, such, for example, as Teneriffe and Terra del Fuego, might, if done with care, furnish useful data in a very interesting branch of geographical inquiry. In a similar spirit, the sea might be fathomed, and water brought up from great depths,—the height and velocity

of waves ascertained,—meteorological tables framed in different climates,—hygrometers and other instruments tried,—mineralogical, zoological and botanical collections of natural history, might also be made, without deviating from the path which an attention to the more useful objects of the voyage would prescribe. The ingenious and valuable theories of Mr Daniell on the constitution of the atmosphere, suggest many curious investigations to the voyager who should have leisure to follow them up.

Fifth Head, General Information.

It is difficult to say to what extent a popular account of the state of manners, domestic and political, might be rendered interesting or useful, if made to embrace so extensive a voyage as that here contemplated. But it can scarcely be doubted, that, in these days of curiosity and research, a simple statement of the characteristic traits of the inhabitants at the principal stations on the different coasts of the world, would not be deemed an unimportant addition to our knowledge. It would be curious, for example, to point out the operation of the causes which have been in action in the South Sea Islands since the days of Cook ; and, generally speaking, to mark the effect of our attempts to civilise and convert the ruder inhabitants of the globe.

It may be remarked, that there are already several detached expeditions sent by this country to different parts of the world. But their objects are all more or less particular, and, though highly useful in themselves, cannot either, jointly or singly, be expected to furnish the results contemplated here, the essential value of which lies in their being part of one connected series, performed by one course of service, and by means of a uniform set of instruments and the same observers. Indeed, it may possibly be true, that to give the detached surveys alluded to their full utility, their particular results ought to be connected by some such general plan as that which is here described.

It is difficult to say precisely what would be the best route to follow, but the following sketch includes most of the places, the geographical situation of which it seems desirable to ascertain more precisely than is at present known, while, at the same time, it takes in those stations at which the pendulum might be swung,

and other scientific observations made, without interfering with the primary object of useful and practical investigation.

The first part of the voyage might include Madeira, Teneriffe, one of the Cape de Verds, Bahia, Rio de Janeiro, Monte Video, Buenos Ayres. The next would include the Falkland Islands, where there is a harbour exactly in the correspondent latitude of that of London; Cape Horn, where there is a secure port almost in the opposite latitude to that of Leith Port, and consequently affording stations well suited for swinging the pendulum, in order to have, as nearly as possible, similar observations in the southern as in the northern hemispheres; thence to the coasts of Chili, Peru, and Colombia, as far as the Equator, and also to the Gallapagos Islands. The third division would sweep the Pacific as far as New Holland, including the various groups of Islands in that interesting region. The next would take in various stations amongst the Islands of the Eastern Archipelago, lying between New South Wales and China. The fifth division would include the Straits of Malacca, the Presidencies of India, Ceylon, the Mauritius, and the Cape. The last would take in St Helena, Ascension, the West Indies, Bermuda, Charlestown, the Azores, and England.

With the exception of one or two, there is none of these places where it would not be useful to the practical seaman to be well acquainted with all, or most, of the points mentioned in the foregoing sketch. Some of the names of the places mentioned, however, have been introduced for the purpose of completing the important series of pendulum experiments, having the effect of local density for their object, and keeping in view the necessity of selecting stations along the same parallels of latitude, but differing as much as possible in the nature of the ground. The following may be stated as two parallels singularly well suited to establish the point in question.

Northern Series.		
Names.	Latitude.	Nature of the Ground.
Madeira,	32½	Insular, volcanic.
Bermuda,	32½	Do. calcareous.
Charlestown,	32¾	Continent, alluvial.
Mogadore, coast of Africa,	32½	Do. Sandy desert.

Southern Series.		
Names.	Latitude.	Nature of the Ground.
River Plate,	34½	Continent, alluvial.
Valparaiso,	33½	Do. primitive,
Juan Fernandez,	33¾	Insular, volcanic.
New South Wales,	33¾	Continent, sandstone.
Cape, -	33½	Do. granite.

There are other parallels in higher latitudes, where, if it were necessary, these experiments might be repeated, but none which offers such conveniencies as the above.

It will readily be admitted by practical men, that such an arduous course of service could only be properly executed by an officer whose sole duty it should be to devote his time and thoughts to its accomplishment. He would require to be supported by numerous and able assistants, and be left in a great measure to the exercise of his own discretion as to the details of the voyage, such as the ports he should touch at, and the periods of his stay at each. As it is well known that the ordinary course of naval duties on foreign stations, occupies the whole of the commanding officer's time, it would be essential to the success of any such voyage as this, that the commander should be left quite free, as far as the nature of the service would allow, from all extraneous duties unconnected with these objects. In war this is impossible,—in peace it is easy; and this is the only time, therefore, that such an enterprise can be thought of.

On Achmite, Hyalosiderite and Trachylyte. By Professor Breithaupt of Freyberg.

I. *Achmite.*

Professor Mitscherlich, in Schweigger's Journal of Chemistry, describes the Achmite, a Norwegian mineral, as a new species. On reading his account, I was immediately struck with the resemblance of this mineral to Augite. I soon had an opportunity of examining a small suite of this mineral, in the collection of Heyer in Dresden, and was convinced *that Achmite was a mere variety of Augite.* I could not find those differences